California State University, Los Angeles

Department of

Mechanical Engineering

College of Engineering, Computer Science, and Technology

PROGRAM ASSESSMENT

2004-2006

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I Introduction

The Mechanical Engineering program provides instruction in the basic sciences, in economic, ethical and social issues, and in engineering design and analysis. The undergraduate program has approximately 150 students and awards the Bachelor of Science in Mechanical Engineering to its graduates. Because mechanical engineering is one of the most general branches of engineering, the breadth and flexibility of a mechanical engineer's education provide a wide choice of careers and movement into a variety of engineering areas.

In general terms, mechanical engineers are concerned with the production, transmission, and use of energy. A series of core courses that is completed by all students in the program provides a general mechanical engineering knowledge. Following the completion of the core courses, the students select their area of specialization from applied mechanics, machine design, thermal-fluid sciences and manufacturing. The undergraduate educational experience is brought to closure with a capstone experience in which teams of seniors are assigned design projects. This capstone experience allows students to utilize of the skills and knowledge they have gained throughout the program.

In 1999, the Mechanical Engineering program implemented a program assessment strategy based on student learning. The motivation for implementing originated in four places:

1. The faculty
2. Accreditation Board for Engineering and Technology
3. The WASC Accreditation guidelines
4. The University faculty handbook

This assessment program that is used to ensure achievement of the objectives and outcomes can be described as in a two-loop figure.

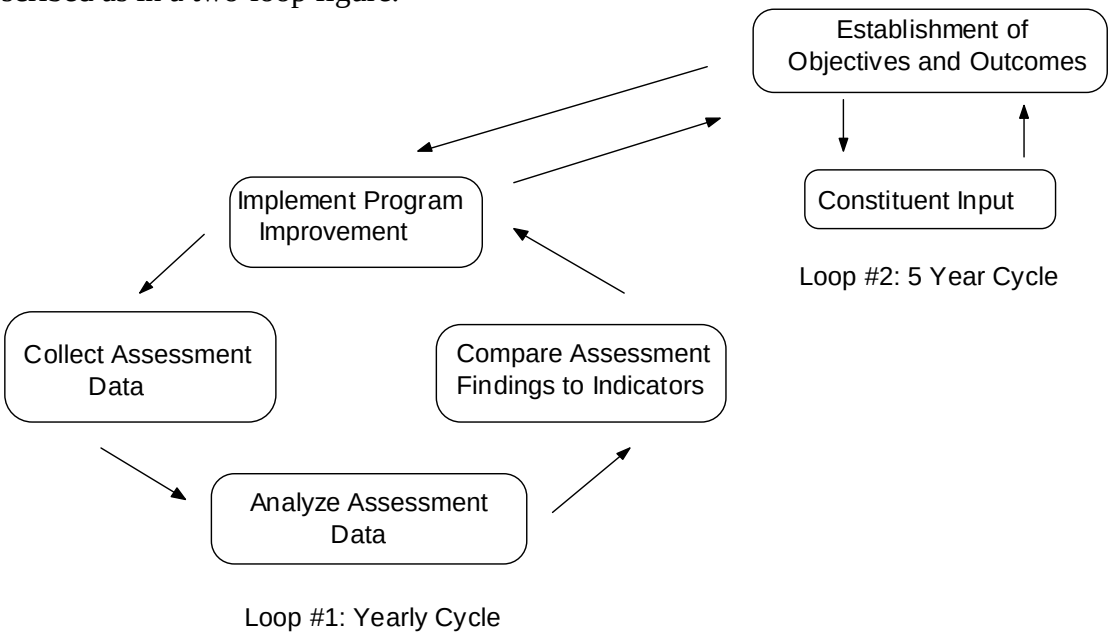


Fig. 1. Yearly implementation of assessment program

Loop #1 is implemented each year. This ensures continual improvement and development of the Mechanical Engineering program. Loop #2 will be implemented every 5 years and was implemented last in 2005. This ensures that the direction in which the program is developing is in line with the desires of the program constituents.

II Combined Resources of the College of Engineering and Technology

Although each of the three mandates above refer to "program" assessment and ultimately, it is the responsibility of the leadership and faculty in each of our five "program" areas (civil engineering, electrical engineering, mechanical engineering, technology, computer science) to handle this task, because each of our units is relatively small we decided that it would be inefficient to have each program launch its own program assessment process. Rather choose to use a co-operative, College-wide effort in which representatives of each of the programs work along with the associate dean to implement the program assessment process. The current assessment team is:

- Jane Dong – EE
- Charles Liu* - EE
- Rupa Purasinghe – CE
- Chengyu Sun – Computer Science
- Darrell Guillaume – ME
- Keith Mew - Technology
- Raj Pamula – Computer Science
- Ben Lee – Acting Associate Dean

III Status of College Vision and Mission Statement

Since the beginning of this assessment process, the definitions of key terminology have been understood to be important. The table below provides the current definitions used by the assessment task force. This is a "living" list in that the number of terms grows and the definitions change over time.

Definition of Key Terms

Term	***Definition***	***Applicable Unit***
Vision	*Where we want to be or how we want to be viewed*	*College*
Mission	*Description of what we do (i.e., what "business" are we in)*	*College*
Educational objectives	*Broad statements of what knowledge our graduates will have, what skills they will possess, and what attitudes they will hold*	*Programs*
Program outcomes	*Measurable indicators that educational objectives have been met (Generally more specific)*	*Programs*
Performance indicators	*Detailed metrics (measures) that indicate whether a specific out-come has been achieved*	*Program*
Performance criteria	*Performance level required to satisfy a particular performance indicator*	*Program*
Constituents (Stakeholders)	*A group of people with common expectations of an educational program (e.g., students, alumni, faculty, staff, employers)*	*College/ Program*

Fig. 2. Definition of Key Terms

The Vision and Mission statements of the College of Engineering, Computer Science, and Technology are:

Vision Statement

To be a pre-eminent engineering, computer science, and technology program that prepares students from diverse backgrounds for productive careers by providing them with a student-centered, practically-focused quality learning experience.

Mission Statement

The mission of the College of Engineering, Computer Science and Technology is to graduate well-educated engineers, computer scientists and technologists who are prepared to meet the challenges of a rapidly changing, increasingly complex world. This will be accomplished through*:*

- *A well-qualified faculty who care about students and their success.*
- *A dynamic, up-to-date curriculum that has an optimal balance between theory and practice.*
- *Laboratories, computer facilities, and instructional classrooms on par with any engineering, computer science and technology program in the nation.*
- *Unique co-curricular opportunities for students such as participation in student design competitions, professional student organizations, and pre-professional employment.*
- *Opportunities for undergraduate and graduate students to participate in research projects.*
- *Mutually beneficial partnerships with area industry that take advantage of our location in one of most concentrated high-tech centers in the nation.*
- *Strong cooperative relationships with local high schools and community colleges.*

IV Status of Educational Objectives and Program Outcomes

Educational outcomes were defined as broad statements of attributes of graduates of the Program demonstrate 3 to 5 years after graduation. We decided to develop three such statements as follows:

1. One statement describing the knowledge that graduates will have
2. One statement describing the skills that graduates will possess
3. One statement describing the attitudes graduates will hold

Every five years these objectives will be reassessed. The process used to develop these statements was to seek input from various "constituencies" (program faculty, program students, industry representatives, employers, alumni) as to what knowledge, skills, and attitudes they believe graduates of the specific program should have.

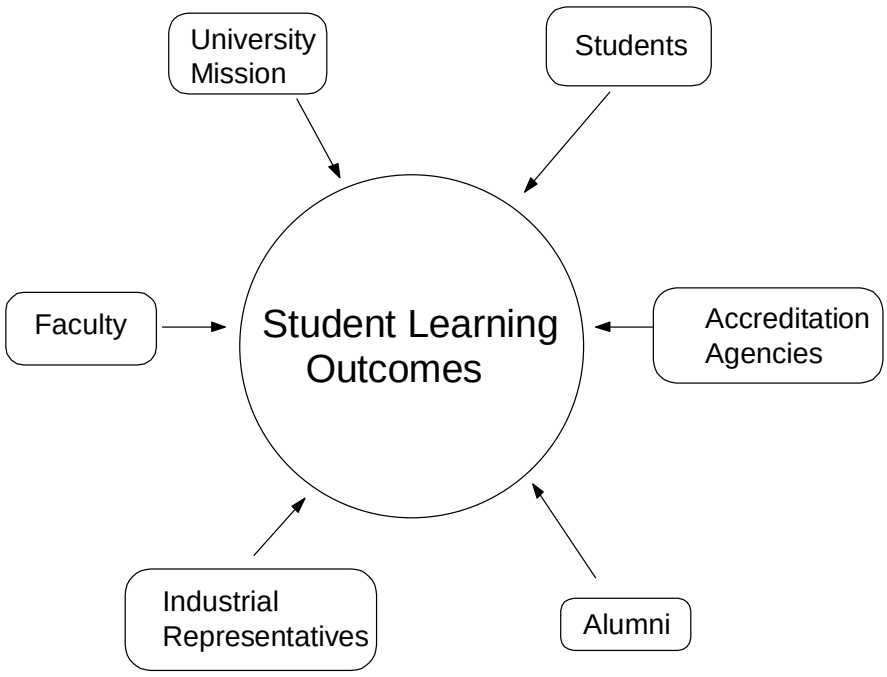


Fig. 3. Determining Student Learning Outcomes

Specifically, the procedure that is used to update the Mechanical Engineering program objective statements and student outcomes is:

1. Survey the constituents to obtain their opinion of the educational objective statements we are currently using and to determine their desired student outcomes for each objective statement.
2. Use the constituent input to modify the objective statements and all of the desired student outcomes.
3. Resurvey the constituents to obtain approval of the modified objective statements and to obtain a ranking of all the desired student outcomes.
4. Send the final draft of the Mechanical Engineering objective statements and corresponding student outcomes to all constituents for final approval.

The educational objective statements for the Mechanical Engineering program that were updated in 2005 are shown below.

Educational Objectives and Program Outcomes
For the Mechanical Engineering Program

The following describe the characteristics that the Cal. State LA Mechanical Engineering program is seeking to produce in its graduates in the three areas:

- *The knowledge they will have*
- *The skills they will possess*
- *The attitudes they will hold*

Knowledge

Graduates of the Mechanical Engineering program will have the knowledge in math, science and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.

This educational objective will be demonstrated by the following outcomes:

1. *an ability to apply knowledge of mathematics, science, and engineering (abet **a**)*
   In particular, an ability to apply knowledge of:
   a) chemistry and calculus-based physics.
   b) advanced mathematics through multivariate calculus and differential equations.
   c) statistics and linear algebra.
2. *an understanding of professional and ethical responsibility (abet **f**)*
3. *the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet **h**)*
4. *knowledge of current events and societal contemporary issues -- non-engineering related. (abet **j**)*
5. *a knowledge of computer aided design and simulation software*
6. *a knowledge of measurement and manufacturing techniques*
7. *an ability to apply common sense*

Skills

Graduates of the Mechanical Engineering program will be able to function competently as an individual or part of a team. They shall be able to analyze, define, and solve thermal, mechanical, manufacturing problems through application of engineering fundamentals and Mechanical Engineering tools logically and effectively as well as communicating the problems and their solutions clearly. They are expected to acquire professional competence in the aforementioned skills within five years.

This educational objective will be demonstrated by the following outcomes:

1. *an ability to design and conduct experiments as well as to analyze and interpret data (abet **b**)*
2. *ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet **c**)*
3. *an ability to function on multidisciplinary teams (abet **d**)*
4. *an ability to communicate effectively (abet **g**)*
5. *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet **k**)*
6. *an ability to visualize designs from engineering drawings*
7. *an ability to identify, formulate, and solve engineering problems (abet **e**)*
8. *an ability to think in a logical, sequential, holistic process*

Attitudes

Graduates of the Mechanical Engineering program will have the confidence in their abilities to be successful in either industrial, governmental, or academic positions, and will have a positive and inquisitive outlook on life and continuous learning, necessary to promote their professional and personal development throughout their careers.

This educational objective will be demonstrated by the following outcomes:

1. *an understanding of professional and ethical responsibility (abet **f**)*
2. *a recognition of the need for an ability to engage in lifelong learning (abet **i**)*
3. *an understanding of responsibility and accountability*
4. *a desire to be a professional that exhibits values, dedication and a need for continual improvement*
5. *a desire to have critical thinking and organizational skills*

V The Assessment Process

Standing Committee

To ensure a continuous assessment process, a permanent committee within the department has been formed. This committee has a 3 year, rotating membership that allows all department faculty to participate in the assessment process. It meets on a bi-monthly basis.

Members: Maj Mirmirani (Chair)
Lih-Min Hsia
Darrell Guillaume
Steve Felszeghy

The purpose of this committee is to ensure that data are collected and analyzed for the current year. Specifically, the committee is charged with:

- specifying the assessment tools
  - ⇒ assessing the effectiveness of current tools
  - ⇒ evaluating possible new tools
- determining the timing for the implementation of assessment tools
  - ⇒ specifying the audience and location
  - ⇒ verifying that the tools are implemented
- analysis of results
- reporting assessment results to the department
- specifying where changes in the curriculum are implemented
- verifying that changes have been implemented
- documenting evidence of the changes

VI Relation between Curriculum and Program Outcomes

The process of documenting where within the curriculum and to what extent each program outcome is being accomplished was conducted during the 2004-2005 academic year.

Each program has a list of course coordinators. Each course coordinator was asked to indicate what program outcomes are being addressed in their course and at what level. Nine points were awarded where the focus on the program outcome is "high," three points where the focus is "medium," one point where the focus is "low," and no points where there is no focus. With these data, the total points were computed for each program outcome. This provided indications of where the curriculum is doing a good job in achieving the program outcome and where there are deficiencies.

Educational Outcome	Current Curriculum Strength
Knowledge	
Graduates of the Mechanical Engineering program will have the knowledge in math, science and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.	

This educational objective will be demonstrated by the following outcomes:	
1. an ability to apply knowledge of mathematics, science, and engineering (abet a) In particular, an ability to apply knowledge of: a) chemistry and calculus-based physics. b) advanced mathematics through multivariate calculus and differential equations. c) statistics and linear algebra.	209
2. an understanding of professional and ethical responsibility (abet f)	73
3. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)	73
4. knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)	47
5. a knowledge of computer aided design and simulation software	115
6. a knowledge of measurement and manufacturing techniques	101
7. an ability to apply common sense systems	188
Skills	
Graduates of the Mechanical Engineering program will be able to function competently as an individual or part of a team. They shall be able to analyze, define, and solve thermal, mechanical, manufacturing problems through application of engineering fundamentals and Mechanical Engineering tools logically and effectively as well as communicating the problems and their solutions clearly. They are expected to acquire professional competence in the aforementioned skills within five years.	
This educational objective will be demonstrated by the following outcomes:	
1. an ability to design and conduct experiments as well as to analyze and interpret data (abet b)	85
2. ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)	128
3. an ability to function on multidisciplinary teams (abet e)	89
4. an ability to communicate effectively (abet g)	141
5. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)	162
6. an ability to visualize designs from engineering drawings	100
7. an ability to identify, formulate, and solve engineering problems (abet e)	190
8. an ability to think in a logical, sequential, holistic process	233
Attitudes	
Graduates of the Mechanical Engineering program will have the confidence in their abilities to be successful in either industrial, governmental, or academic positions, and will have a positive and inquisitive outlook on life and continuous learning, necessary to promote their professional and personal development throughout their careers.	
This educational objective will be demonstrated by the following outcomes:	
1. an understanding of professional and ethical responsibility (abet f)	72
2. a recognition of the need for an ability to engage in lifelong learning (abet i)	126
3. an understanding of responsibility and accountability	84
4. a desire to be a professional that exhibits values, dedication and a need for continual improvement	98
5. a desire to have critical thinking and organizational skills	135

Fig. 4. Current Curriculum Strength for Each Outcome

VII Assessment Tools and Process

The schedule for implementation of the assessment tools is shown in Fig. 5.

Assessment Tool	Implementation Frequency	Year Results are Reported
1 Capstone design course		
a Oral presentation (Appendix 2)	Every Year	**This Report**
b Written presentation	Every two Years*	2006-2007
2 Webfolio		
a Industry Assessment	Every Three Years	**This Report**
b Faculty Assessment (Appendix 3)	Every Three Years	2007-2008
c Alumni Assessment (Appendix 3)	Every Three Years	2006-2007
3 Surveys of seniors (Appendix 4)	Every Year	**This Report**
4 Surveys of recent graduates	Every Five Years	2004-2005
5 Survey of Faculty	Every Five Years	2004-2005
6 Surveys of employers	Every Five Years	2004-2005
7 Educational Benchmarking Inc. Survey (Appendix 5)	Every Year	Supplemental Report
8 Engineering-in-Training Exam	Every Year	Supplemental Report

Fig. 5. Implementation Schedule for Assessment Tools

A matrix of which program outcome can be assessed by each assessment tools is shown below.

Assessment Tool versus Student Outcome

	Capstone Course	Webfolios	Surveys of Employers	Surveys of Students	Pretests/ Tests
Knowledge					
Math/Science/Engineering	No	No	**Yes**	**Yes**	**Yes**
Contemporary Issues	No	No	**Yes**	**Yes**	No
Broad Education	No	No	**Yes**	**Yes**	No
Ethics	**Yes (Test)**	No	**Yes**	**Yes**	No
Skills					
Experimental work	Maybe	**Yes**	**Yes**	**Yes**	No
Problem solving	**Yes**	No	**Yes**	**Yes**	No
Design	**Yes**	**Yes**	**Yes**	**Yes**	No
Communication skills	**Yes**	**Yes (written)**	**Yes**	**Yes**	**Yes (WPE)**
Work in teams	**Yes**	No	**Yes**	**Yes**	No
Use tools	**Yes**	No	**Yes**	**Yes**	No
Information competency	Maybe	No	**Yes**	**Yes**	No
Attitudes					
Lifelong learning	No	No	**Yes**	**Yes**	No
Professionalism	**Yes**	**Yes**	**Yes**	**Yes**	No
All other attitudes	No	No	**Yes**	**Yes**	No

Fig. 6. Corresponding Assessment Tool for Each Student Outcome

The data obtained from these initiatives were compiled, analyzed, and interpreted during the 2004-2006 assessment period.

VIII Results of Assessment

New Objectives and Outcomes and New Rubrics

In last year's study, we determined the strongest outcomes and the areas for improvement that were identified by 1) student input, 2) alumni input, and 3) industry input. These are presented below.

Strengths **(for 2002-2004)**

Strengths

- Knowledge of contemporary Issues
- An understanding of responsibility and accountability
- A recognition of the need for an ability to engage in lifelong learning
-
- A desire to be a flexible and adaptable team player (collaborative attitude)
- A knowledge of current events and societal contemporary issues – non engineering related
- A desire to be a professional that exhibits values, dedication and a need for continual improvement
- Ability of the students to address economic issues, and ethical and concerns social concerns

Areas for Improvement

- An Ability to Design and Conduct Experiments as Well as to Analyze and Interpret Data
- An Ability to Communicate Effectively
- An Ability to Apply Knowledge of Mathematics, Science, and Engineering – Specifically, an "Area for Improvement" in Dynamics
  (See Mechanical Engineering program Assessment 2002-2004 for more details).

For past reports, the major goal is to compare the results of this assessment period with last year's result and determine if the outcome that corresponds to the area has:

1. improved
2. declined
3. not changed

This report is however different because both the objectives, outcomes, and most of the rubrics have changed. Thus, in most cases it is not a good presentation of data to graphically show previous findings next to current findings. The exceptions are the webfolio and the EBI survey. Since those tools only focus on the a-k criteria, the rubrics and outcomes have not changed and the new data can be directly plotted next to previous data and will provide good graphical comparison.

As in previous reports, for each assessment tool, thresholds are identified. Although all outcomes vary in performance from year to year, only the weakest performing outcomes (those scoring below threshold levels) are considered an "area for improvement." As those are improved, the threshold is raised and other outcomes will then be identified as an Area for Improvement based on their measured performance.

Capstone design course

Oral Presentation

For the 2004-2006 assessment process, the final oral presentation in the senior design capstone course was used to assess the following outcomes:

1) describe the project objective and communicate clearly?
   an ability to communicate effectively (abet g)
2) apply engineering analysis?
   an ability to apply knowledge of mathematics, science, and engineering (abet a)
3) conduct tests and analyze data to verify engineering analysis?
   an ability to design and conduct experiments as well as to analyze and interpret data (abet b)
4) design a system or component?
   an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)
5) to understand the impact of engineering in a societal context?
   the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
6) use modern engineering tools/techniques?
   an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
7) function as a cohesive team?
   an ability to function on multidisciplinary teams (abet e)
8) display professionalism?
   an understanding of professional and ethical responsibility (abet f)
9) knowledge of contemporary issues?
   knowledge of current events and societal contemporary issues (non-engineering related. (abet j))

Each student group presented a formal oral presentation which was 15 minutes long and addressed audience questions in a subsequent 5-minuute question period. There are typically between two and three students per group and each group member is required to participate in the oral presentation (i.e. each student speaks for approximately five minutes).

Using the instrument shown in Appendix 2, the following constituents were assessed:

- fellow students
- faculty
- industrial constituents

The results, shown below, are based on a 0 to 4 point scale with 4 being the highest.

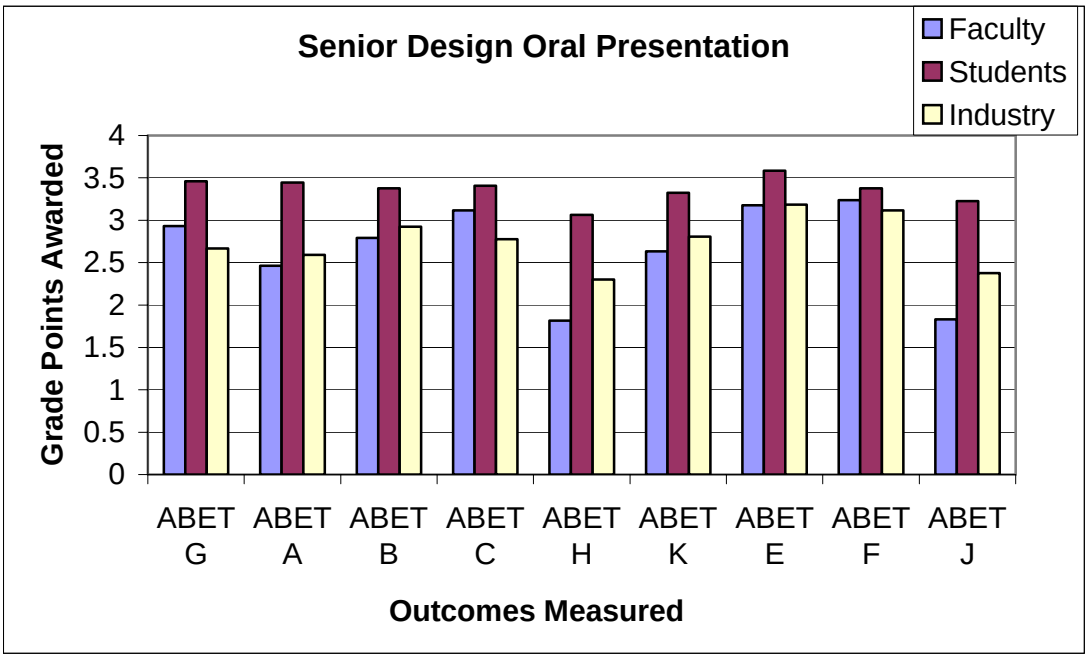


Fig.7. Faculty, Student, and Industry Assessment of the Final Oral Presentation in the Senior Capstone Course

2004-2006 Observations

Faculty

Strength identified: None

Area for improvement identified: To understand the impact of engineering in a societal context
Knowledge of contemporary Issues

Students

Strength identified: function as a cohesive team

Area for improvement identified: To understand the impact of engineering in a societal context

Industrial Constituents

Strength identified: function as a cohesive team

Area for improvement identified: To understand the impact of engineering in a societal context
Knowledge of contemporary Issues

Surveys of seniors

The opinions of senior students were assessed using the survey shown in Appendix 4 on the following outcomes:

Key for Curriculum Assessment

1. An ability to apply knowledge of mathematics, science, and engineering (abet **a**)
   In particular, an ability to apply knowledge of:
   a chemistry and calculus-based physics
   b advanced mathematics through multivariate calculus and differential equations
   c statistics and linear algebra
2. An understanding of professional and ethical responsibility (abet **f**)
3. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet **h**)
4. Knowledge of current events and societal contemporary issues -- non-engineering related. (abet **j**)
5. A knowledge of computer aided design and simulation software
6. A knowledge of measurement and manufacturing techniques
7. An ability to apply common sense
8. An ability to design and conduct experiments as well as to analyze and interpret data (abet **b**)
9. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet **c**)
10. An ability to function on multidisciplinary teams (abet **d**)
11. An ability to communicate effectively (abet **g**)
12. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet **k**)
13. An ability to visualize designs from engineering drawings
14. An ability to identify, formulate, and solve engineering problems (abet **e**)
15. An ability to think in a logical, sequential, holistic process
16. An understanding of professional and ethical responsibility (abet f)
17. A recognition of the need for an ability to engage in lifelong learning (abet i)
18. An understanding of responsibility and accountability
19. A desire to be a professional that exhibits values, dedication and a need for continual improvement
20. A desire to have critical thinking and organizational skills

As mentioned previously, past reports have also included past results for graphical comparison. This is not possible in this report since both the outcomes and the measure curriculum strength have changed since this is the first report after the completion of the “five-year” loop.

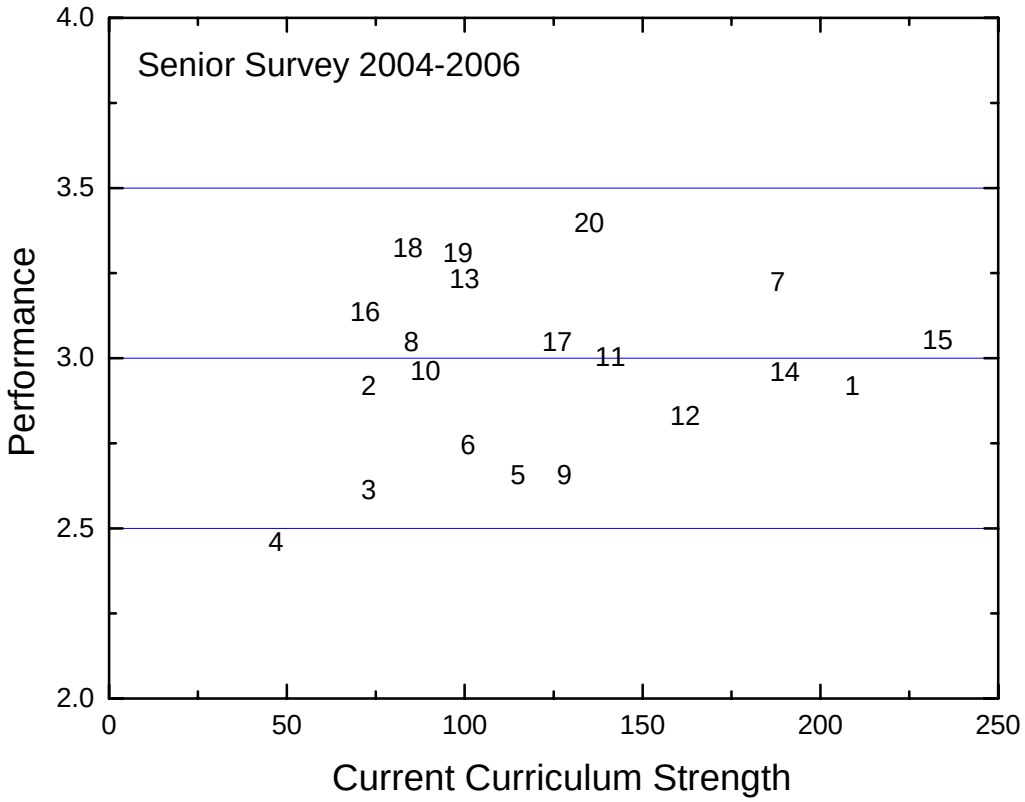


Fig. 8. Graph Showing Student Opinion of Outcome Performance Versus the Current Curriculum Strength (See Key for Curriculum Assessment on previous page)

2004-2006 Observations

Strength identified: An understanding of responsibility and accountability
A desire to have critical thinking and organizational skills

Area for improvement identified: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
Knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)
A knowledge of computer aided design and simulation software

EBI Data and Analysis

At the time that this report was written, the 2004-2006 EBI data were not available yet. The processed information usually arrives from EBI in the Fall. When this data is available, it will be assessed and an addendum to this report will be created.

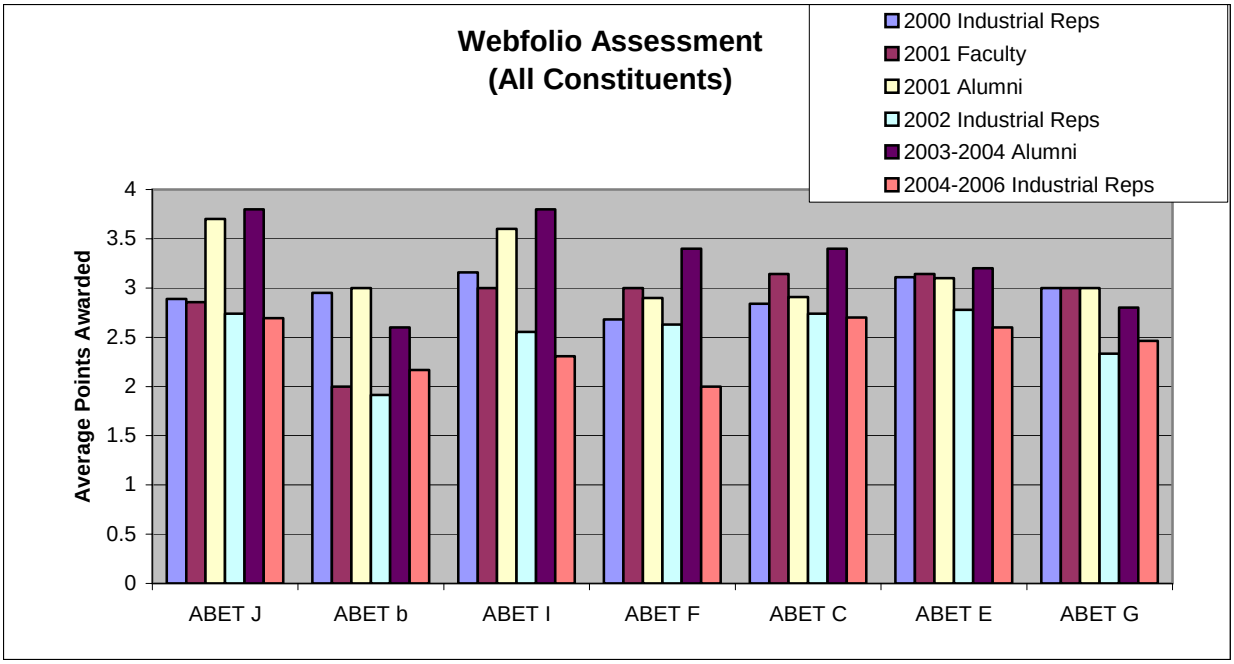
Webfolio

Webfolios are web-based portfolios that are used to collect key elements that correspond to the program's student learning outcomes. These elements are collected throughout the students' academic career at Cal. State LA with the final design element collected in the students' senior level capstone course. The complete portfolios are assessed by selected members of the program's constituents with a rubric based on the program's outcomes. The elements included in the portfolio are:

- A lifelong learning plan
- A resume'
- A laboratory report
- An executive summary of the student's capstone design project

The Internet location of the webfolio along with an assessment rubric were emailed to Industrial Representatives, Faculty, and Alumni to obtain their assessment of this sample work. The goal of these webfolios is to evaluate the following outcomes:

- abet (b) An ability to design and conduct experiments as well as to analyze and interpret data
- abet (c) An ability to design a system, component, or process to meet desired needs
- abet (e) An ability to think in a logical sequential process that lends itself to identifying, formulating and solving engineering problems
- abet (f) An understanding of professional and ethical responsibility
- abet (g) An ability to communicate effectively
- abet (i) A recognition of the need for an ability to engage in lifelong learning
- abet (j) Knowledge of current events and societal contemporary issues -- non-engineering related.



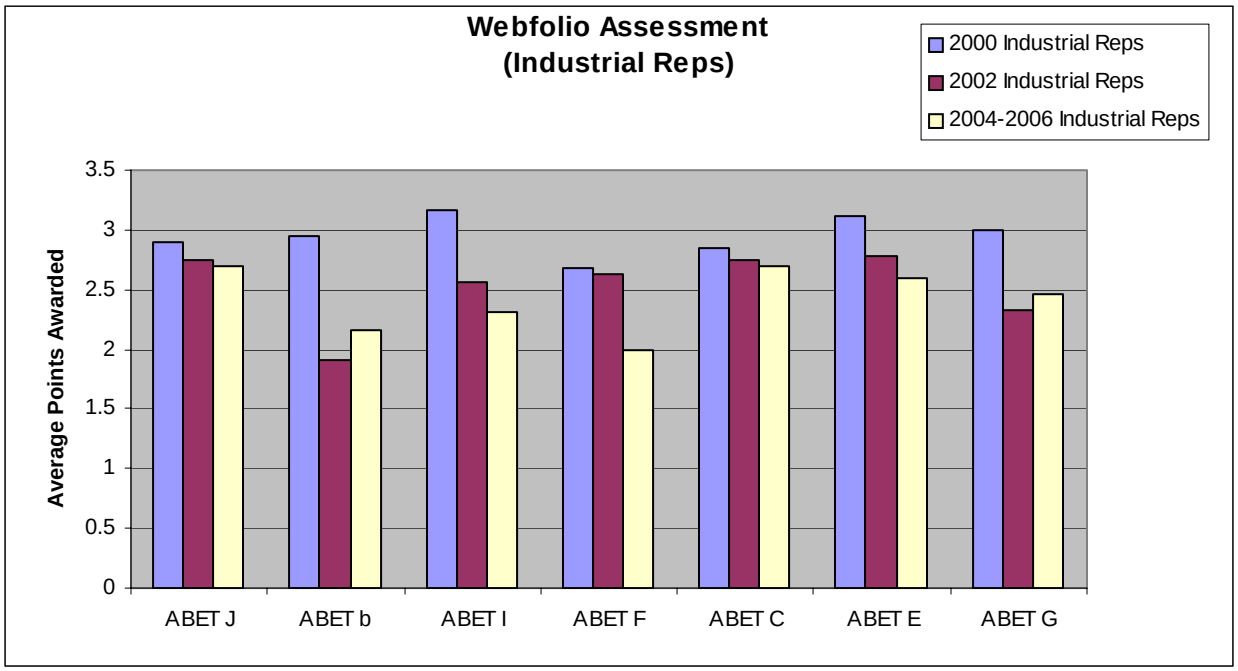


Fig. 9. Graphs Comparing Webfolio Results Obtained from Alumni Faculty and Industrial Representatives

2001-2002 Areas for Improvement (Industrial Reps.)	2004-2006 Performance
An ability to design and conduct experiments as well as to analyze and interpret data	Improved
A recognition of the need for an ability to engage in lifelong learning	Declined
An ability to communicate effectively	Improved

2002-2004 Observations

Strength identified: An ability to communicate effectively

Area for improvement identified: An understanding of professional and ethical responsibility
A recognition of the need for an ability to engage in lifelong learning

Engineer in Training Exam (EIT)

ABET Criteria 2000 include "nationally-normed subject content examinations" as one component of an effective assessment program. Because the EIT is designed to focus on the basic "*ability to apply knowledge of mathematics, science, and engineering (abet a)",* it is the ideal nationally-normed exam to assess engineering programs. Nationwide, colleges are beginning to make the attempt at this exam a requirement for graduation.

Currently, the Mechanical Engineering program is collecting data from the senior students who have attempted the EIT. Although passing the exam is not a graduation requirement, attempting the exam is. The college currently reimburses students who successfully pass the exam to provide motivation for success. Because we graduate a small number of students per year, we are waiting to utilize this information once we have data on a significant number of students.

For this assessment period, 32 students attempted the exam and 12 passed. A separate report has been produced with the EIT data (see Mechanical Engineering EIT Report)

IX Program Strengths and Areas for Improvement Identified

Mechanical Engineering Strengths and Areas for Improvement 2004-2006

Interpretation of the assessment data can be very difficult because often an outcome identified as a strength by one constituent is identified as an “area for improvement” by another constituent. Thus, for the department’s analysis of this data, the majority of the constituents had to identify and agree that a particular outcome was a strength or “area for improvement.” These are presented below along with the corresponding changes that have been identified to improve the program.

Strengths

- A desire to have critical thinking and organizational skills
- Ability to function as a cohesive team
- An understanding of responsibility and accountability
- A desire to have critical thinking and organizational skills
- An ability to communicate effectively
- A desire to be a professional that exhibits values, dedication and a need for continual improvement
- Ability of the students to address economic issues, and ethical and concerns social concerns

Areas for Improvement

- To understand the impact of engineering in a societal context
- Knowledge of contemporary Issues
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

X Program Modifications

The department agrees with the findings of the assessment results outlined above as the "Areas for Improvement." They are related to the broad education that our students receive outside of the traditional engineering curriculum. Since our students must complete a very rigorous general education curriculum, this assessment process is either showing that 1) it is the wrong curriculum for our program or 2) our students are not being given the opportunity to demonstrate that they have a broad education while they are being assessed.

Assessing the General Education Requirement in our Program

Although the department can not easily change the courses required for general education, it can control the courses that students can select within the general education program. In the Fall, the department will create a subcommittee to address the general education courses and make recommendations for requiring specific courses within the GE requirements that will specifically address these issues. We will then take steps to make theses courses mandatory for Mechanical Engineering students. This step will help our students learn more about contemporary issues and how engineering and technology impacts society. We will continue to monitor the impact of this change to make sure it has had the desired effect.

Altering the Assessment Process

1. Two changes are proposed to the assessment process: 1) increase the amount of time provided during the capstone oral presentation and 2) change the webfolio requirements for contemporary issues.

Currently, the capstone presentation is 15 minutes long with 5 minutes for questions. Because of this short period, students are forced to immediately present their engineering solutions without taking the time to present the problem background and impact on society. The presentation time will be increased to 20 minutes with 5 minutes for questions starting next year. The student will also be instructed to consider and explain their project's impact on society during their presentation.

2. The current webfolio instructions read:

"A knowledge of current events and contemporary issues (non-engineering related) will benefit you in your engineering career. "

Write a one paper discussing the above statement. Discuss not only how and why you will benefit, but give examples.

These are being modified to read:

This essay needs to be written in two sections:

1. *Write a one page paper discussing the statement: "How knowledge of current events and contemporary issues (non-engineering related) will benefit you in your engineering career." Discuss not only how and why you will benefit, but give examples.*

2. *Read a recent news article from a local newspaper or a national news magazine. The article's topic needs to be a current event / contemporary issue. Example topics include the economy (stock market, oil prices), world events (war, elections), local events (zoning changes, enrolment in school) or other events that are in the news. Write a one page discussion of this event and include the name and date of the source.*

The Department believes that if students are actually required to research contemporary issues, they are more likely to be aware of the impact of engineering on society.

Appendices

Appendix 1: Sample Course Coordinator Survey

To: Professor _____
Course Coordinator for _____

From: Assessment Coordinator
Subject: ABET Course Coordinator Survey

We are seeking your input to determine which, and to what degree, the mechanical engineering program outcomes are 1) currently being met by ME_____ and 2) could be met in ME_____ with minor course modifications in the future. If you have any questions, please do not hesitate to contact me.

Please indicate with
H=High M=Medium L= Low N= No

1) knowledge:

Graduates of the Mechanical Engineering program will have the knowledge in math, science and engineering fundamentals, as well as societal issues, that allows them to approach real-world Mechanical Engineering problems with an understanding of their impact on society.

Measurable outcomes:	current	future
an ability to apply knowledge of mathematics, science, and engineering (abet a) In particular, an ability to apply knowledge of: a) chemistry and calculus-based physics. b) advanced mathematics through multivariate calculus and differential equations. c) statistics and linear algebra.		
an understanding of professional and ethical responsibility (abet f)		
the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)		
knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)		
a knowledge of computer aided design and simulation software		
a knowledge of measurement and manufacturing techniques		
an ability to apply common sense		

2) Skills

Graduates of the Mechanical Engineering program will be able to function competently as an individual or part of a team. They shall be able to analyze, define, and solve thermal, mechanical, manufacturing problems through application of engineering fundamentals and Mechanical Engineering tools logically and effectively as well as communicating the problems and their

solutions clearly. They are expected to acquire professional competence in the aforementioned skills within five years.

Measurable outcomes:	current	future
an ability to design and conduct experiments as well as to analyze and interpret data (abet b)		
ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)		
an ability to function on multidisciplinary teams (abet e)		
an ability to communicate effectively (abet g)		
an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)		
an ability to visualize designs from engineering drawings		
an ability to identify, formulate, and solve engineering problems (abet e)		
an ability to think in a logical sequential process		

3) Attitudes

Graduates of the Mechanical Engineering program will have the confidence in their abilities to be successful in either industrial, governmental, or academic positions, and will have a positive and inquisitive outlook on life and continuous learning, necessary to promote their professional and personal development throughout their careers.

Measurable outcomes:	current	future
an understanding of professional and ethical responsibility (abet f)		
a recognition of the need for an ability to engage in lifelong learning (abet i)		
an understanding of responsibility and accountability		
a desire to be a professional that exhibits values, dedication and a need for continual improvement		
a desire to have critical thinking and organizational skills		

Appendix 2: Sample Capstone Oral Presentation Assessment Tool

Date: _____

Please circle the appropriate response.

Student Faculty Industrial Representative

If applicable to the senior design report being assessed, to what extent has the team demonstrated their ability to:

(1 shows high ability ……...…. 5 shows poor ability)	High Low
10) describe the project objective and communicate clearly? *an ability to communicate effectively (abet g)*	1 2 3 4 5 NA
11) apply engineering analysis? *an ability to apply knowledge of mathematics, science, and engineering (abet a)*	1 2 3 4 5 NA
12) conduct tests and analyze data to verify engineering analysis? *an ability to design and conduct experiments as well as to analyze and interpret data (abet b)*	1 2 3 4 5 NA
13) design a system or component? *an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)*	1 2 3 4 5 NA
14) to understand the impact of engineering in a societal context? *the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)*	1 2 3 4 5 NA
15) use modern engineering tools/techniques? *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)*	1 2 3 4 5 NA
16) function as a cohesive team? *an ability to function on multidisciplinary teams (abet e)*	1 2 3 4 5 NA
17) display professionalism? *an understanding of professional and ethical responsibility (abet f)*	1 2 3 4 5 NA
18) knowledge of contemporary issues? *knowledge of current events and societal contemporary issues (non-engineering related. (abet j))*	1 2 3 4 5 NA

Appendix 3: Sample Webfolio Assessment Sheet

Date: _____ **Reviewer's Name: _____**
Student's Name: _____

MECHANICAL ENGINEERING WEBFOLIO ASSESSMENT

Industrial Representatives:

Please consider the 5 Folders in the Student's Web folio and rate the student's performance.
5 shows high ability ……...…. 0 shows poor ability
NA shows that there is insufficient evidence to make a judgment

For the **Benefits of Current Issues** Folder, how well has the student demonstrated:	
Knowledge of current events and societal contemporary issues -- non-engineering related. (abet j)	5 4 3 2 1 NA

For the **Lab Report** Folder, how well has the student demonstrated:	
An ability to design and conduct experiments as well as to analyze and interpret data (abet b)	5 4 3 2 1 NA

For the **Life Long Learning Plan** Folder, how well has the student demonstrated:	
A recognition of the need for an ability to engage in lifelong learning (abet i)	5 4 3 2 1 NA

For the **Resume** Folder, how well has the student demonstrated:	
An understanding of professional and ethical responsibility (abet f)	5 4 3 2 1 NA

For the **Senior Design Project Extended Abstract** Folder, how well has the student demonstrated:	
An ability to design a system, component, or process to meet desired needs (abet c)	5 4 3 2 1 NA
An ability to think in a logical sequential process that lends itself to identifying, formulating and solving engineering problems (abet e(abet e)	5 4 3 2 1 NA

For the **Overall Webfolio Presentation**, how well has the student demonstrated:	
An ability to communicate effectively (abet g)	5 4 3 2 1 NA
An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)	5 4 3 2 1 NA

Appendix 4: Sample Student Survey

Senior Survey
Mechanical Engineering

Name: _____
Today's Date: _____
Expected Graduation Year: _____

Question	**Rating**
How satisfied are you with your education at CSULA in meeting the following: **(1 is very satisfied …….. 5 is very dissatisfied)**	**Satisfied** **Dissatisfied**
Knowledge	
1. an ability to apply knowledge of mathematics, science, and engineering (abet **a**)	1 2 3 4 5 NA
2. an understanding of professional and ethical responsibility (abet **f**)	1 2 3 4 5 NA
3. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet **h**)	1 2 3 4 5 NA
4. knowledge of current events and societal contemporary issues -- non-engineering related. (abet **j**)	1 2 3 4 5 NA
5. a knowledge of computer aided design and simulation software	1 2 3 4 5 NA
6. a knowledge of measurement and manufacturing techniques	1 2 3 4 5 NA
7. an ability to apply common sense	1 2 3 4 5 NA
Skills 1. an ability to design and conduct experiments as well as to analyze and interpret data (abet **b**)	1 2 3 4 5 NA
2. ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet **c**)	1 2 3 4 5 NA
3. an ability to function on multidisciplinary teams (abet **d**)	1 2 3 4 5 NA
4. an ability to communicate effectively (abet **g**)	1 2 3 4 5 NA
5. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet **k**)	1 2 3 4 5 NA
6. an ability to visualize designs from engineering drawings	1 2 3 4 5 NA
7. an ability to identify, formulate, and solve engineering problems (abet **e**)	1 2 3 4 5 NA

8. an ability to think in a logical, sequential, holistic process	
Do you agree that your education at CSULA provided the following: **(1 is agree …….. 5 disagree)**	**Agree Disagree**
<u>Attitudes</u>	
1. an understanding of professional and ethical responsibility (abet f)	1 2 3 4 5 NA
2. a recognition of the need for an ability to engage in lifelong learning (abet **i**)	1 2 3 4 5 NA
3. an understanding of responsibility and accountability	1 2 3 4 5 NA
4. a desire to be a professional that exhibits values, dedication and a need for continual improvement	1 2 3 4 5 NA
5. a desire to have critical thinking and organizational skills	1 2 3 4 5 NA

Appendix 5: Survey of Recent Graduates (EBI)

Educational Benchmarking Inc. develops national benchmarking studies that allow the user to analyze their performance and compare the results to select peers and competitors.

In the survey instrument used in this study, questions 38 to 66 come directly from ABET Criteria 2000 standards. Participating colleges will be sent surveys and asked to distribute and collect surveys from graduating students either in senior design sections or as part of a "filing for graduation" process.

Colleges are able to choose six peer institutions from which to receive specific comparative data. Confidentiality of all college data is maintained by the reporting structure which does not identify who is who within the comparison group.

Seventy-one questions were asked covering satisfaction of graduates in the following fourteen major categories:

Quality of instruction in major courses (Questions 1-5)
Quality of teaching in math and science courses (Questions 6-9)
Other aspects of major courses (Questions 10-13, 14-17,20, 21)
Co-curricular activities (Questions 18-19)
Academic advising (Questions 24, 25)
Computing resources (Questions 26-29)
Characteristics of fellow students (Questions 30-32)
Career services and placement (Questions 33-37)
Engineering Skill Development (Questions 38-44, 47, 50, 51)
Ethics, global context, lifelong learning (Questions 45, 46, 52)
Oral and written communication (Questions 48, 49)
Capstone design experience (Questions 53-63)
Laboratory facilities (Questions 64-66)
Overall satisfaction with engineering program (67-71)